SIEMENS

Physician's Guide To Interpretation Criteria

For BURDICK Interpretive Electrocardiographs

BURDICK E 500

BURDICK E 550

BURDICK E 600

BURDICK ELITE

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CONTENTS

I. Miscellaneous

- a. Arm lead reversal
- b. Dextrocardia
- c. Ventricular pre-excitation (WPW)
  - 1. Type A
  - 2. Type B
  - 3. Atypical
- d. Atrial enlargement
  - 1. Right
  - 2. Left
- e. Axis deviations
  - 1. Left
  - 2. Right
  - 3. Indeterminate
- f. Low QRS voltage and related phenomena
  - 1. Low limb lead voltage
  - 2. Low chest lead voltage
  - 3. S1-S2-S3 pattern
  - 4. Pulmonary disease

II. Conduction Abnormalities

- a. Right bundle
  - 1. RSR' (QR) pattern
  - 2. Incomplete right bundle branch block
  - 3. Right bundle branch block
  - 4. RBBB + RVH
- b. Left bundle
  - 1. Left bundle branch block
  - 2. Left anterior fascicular block
  - 3. Left posterior fascicular block
- c. Nonspecific abnormality
  - 1. Intraventricular delay
  - 2. Intraventricular block

III. Hypertrophy

- a. Right ventricle
  - 1. RVH
  - 2. RVH + repolarization abnormality

b. Left ventricle
    1. LVH (voltage only)
    2. LVH
    3. LVH + repolarization abnormality

IV. Myocardial Infarction

a. Anterior
b. Septal
c. Lateral
d. Inferior
e. Inferior + posterior
f. Infarct suppressions

V. ST elevation

a. Nonspecific ST elevation
b. Early repolarization
c. Pericarditis
d. Subepicardial injury
    1. Septal
    2. Anterior
    3. Lateral
    4. Inferior

VI. ST depression
a. Junctional
b. ST segment
c. Subendocardial injury

VII. T wave abnormalities
a. Ischemia
    1. Anterior
    2. Lateral
    3. Inferior
b. Abnormal QRS-T angle
c. Nonspecific T wave abnormality
d. Tall T wave
e. QT interval

PROLOGUE

The following sections document the criteria used in Mortara Instrument electrocardiographs to interpret acquired 12-lead ECGs. Several conventions are used for reasons of brevity, and at the same time, completeness. These include:

At the beginning of the interpretation process a test element is defined for each interpretation. All such elements are set false at the beginning of the interpretation process. Occasionally these elements are explicitly defined for later use, but most frequently they are implicitly defined (as true) when the corresponding interpretive statement is issued.

Following each interpretive statement two acronyms will be found. The first acronym, "ABC" is an abbreviation or acronym for the statement. These are used subsequently when a reference must be made to a prior statement, as for example when suppression of a previous statement is required. The second part, "XYZ" represents a condition associated with the statement. The possible variations are:

NML	Normal ECG
ATY	Atypical ECG - meaning an unusual pattern has been observed, but which has no specific significance.
BO	Borderline ECG - used where criteria have limited specificity or prognostic significance or where only minimal criteria are met.
ABN	Abnormal
NFI	No Further Interpretation - used where, upon detecting the phenomenon in question, no further useful interpretation of the record is possible.
X	No Condition Associated - used with statement prefixes and suffixes

Interpretive statements have two components: (1) the actual interpretive text, and (2) the optional "reason" statement, which immediately follows in each statement below, and which provides a short synopsis of the principle criteria used to reach the specified conclusion. The intention is to provide these reason statements where users find them helpful. They can be omitted on all ECGs via a setup function on the electrocardiograph.

Interpretation of the ECG proceeds in the sequence of the criteria listing. Ordinarily the last valid statement or conclusion reached within a given section supplants all prior statements (usually weaker forms) in the same section. Whenever suppression of statements from previous sections is required, an explicit "suppress" statement is used. Whenever multiple statements are possible within a section, a "_____" will separate the logically independent subsections

ARM LEAD REVERSAL & DEXTRACARDIA

Criteria:

```
IF:                 QRS axis > 90
          and       P axis > 90
          and       PR durations > 110 ms
          and               Q(I) > 0
               or           Q(I) = 0 and R(I) < 150

               then if:       R(V6) >= 500 μV
                              or
                              R(V6) > S(V6)
                              or
                              P(V6) >= 20 mV
                              or
                              P'(V6) >= -20 mV

          say "Arm leads reveresed"
              "Inverted P & QRS in lead I"          ARM.     ATYP

          otherwise say "Dextrocardia"
                        "Inverted P & QRS in lead V6" DEX.   ATYP
```

Rationale:

Simultaneously negative P and QRS contours in lead I are unlikely in a properly recorded ECG. If, in addition, the QRS has a Qr (or rSr') configuration, the most probable explanation is that the arm leads are reversed or destrocardia is present. If lead V6 has a typical upright configuration, arm lead reversal is more likely: otherwise, dextrocardia is the remaining plausible explanation.

Although the reason statement for both lead reversal and dextrocardia mentions only the inverted P & QRS in lead I, the requirement of a Qr (rSr') morphology is important. Pulmonary disease, for example, can readily cause right axis deviation of both the P and QRS, but the QRS configuration is rS in this and other typical right heart diseases. A Qr configuration may occur in rare instances from lateral infarction, but a simultaneously inverted P in such events would be unexpected.

WPW

```
Skip test if:       Coupled P wave to QRS is not present
              or    PR duration > 170 ms
              or    QRS duration < 100 ms
              or    Heart rate > 120 BPM
              or    QRS duration > 200 ms
              or    PR duration > 100 ms and QRS duration > 160 ms

Criteria:

IF:                 PR duration < 140
              and   Delta wave is present in 2 leads

                    say "Atypical Wolff-Parkinson-White Pattern"
                                                    WPWZ.      ABN

IF:                 Delta wave is present in 2 leads
              and   R amp > S amp in V1

                    say "Type A Wolff-Parkinson-White Pattern"
                                                    WPWA.      ABN

IF:                 Delta wave is present in 2 leads
              and   S amp >= R amp in V1
              and   PR duration < 140 ms

              or    QRS area ratio > 0.4 in 1 of I/V5/V6
              and   R dur > 30 in V2

                    say "Type B Wolff-Parkinson-White Pattern"
                                                    WPWB.      ABN
```

ATRIAL ENLARGEMENT

Criteria:

IF: Heart rate ≤ 120
and P amp ≥ 250 μV in any of leads II/III/aVF/V1/V2

say "Possible right atrial enlargement"
"0.25 mV P wave" RAE. BO

IF: Heart rate ≤ 120
and P amp ≥ 300 μV in any of leads II/III/aVF/V1/V2

say "Right atrial enlargement"
"0.3 mV P wave" RAE. ABN

IF: P' amp ≤ -100 μV in V1 or V2
and negative P' wave area >= 4000 μV/ms in same lead

say "Possible left atrial enlargement"
"-0.1 mV P wave in lead V1/V2" LAE. BO

IF: P' amp ≤ -150 μV in V1 or V2
and negative p' wave area >= 6000 μV/ms in the same lead

say "Left atrial enlargement" LAE. ABN
"-0.15 mV P wave in lead V1/V2"

Rationale:

The criteria are the customary ones. For those records meeting only minimal criteria, the qualifier "possible" is used to convey this information. Right atrial enlargement is not "read" for rates of 120 or above, for the reason that it is unclear whether increased P amplitude at elevated rates is properly attributed to enlargement.

AXIS DEVIATION

Criteria:

IF:		QRS axis < -20		
		say "Moderate Left axis deviation" "QRS axis < -20"	LAD.	BO
IF:		QRS axis < -30		
		say "Abnormal Left axis deviation" "QRS axis < -30"	LAD.	ABN
IF:		QRS axis > 90		
		say "Moderate Right axis deviaiton" "QRS axis > 90"	RAD.	BO
IF:		QRS axis > 100		
	and	age > 15		
		say "Abnormal Right axis deviation" "QRS axis > 100"	RAD.	ABN
IF:		The total net QRS amplitude in leads I, II and III is < 33% of the total QRS deflection in leads I, II and III		
		say "Indeterminate axis"	QAX.	ATY

Rationale:

The criteria are more or less conventional. Borderline cases are characterized by the use of the terms "moderate". (Axis deviation statements are omitted when subsequently identified diagnostic categories may be regarded as the probably cause of the axis deviation.)

Whenever the net amplitude is a small fraction of the total QRS deflection in each lead, the measurement of axis is lacking in meaning. The term "indeterminate axis" is used to convey this information.

LOW VOLTAGE AND S1-S2-S3 PATTERN

Skip test if: QRS duration >= 120 ms

Criteria:

IF: (a) Total QRS deflection < 500 μV in all limb leads

say "Low QRS voltage in limb leads"
"QRS deflection < 0.5 mV in limb leads"
LVL. ATYP

IF: (b) Total QRS deflection < 1000 μV in all V leads

say "Low QRS voltage in chest leads"
"QRS deflection < 1.0 mV in chest leads"
LVV. ATYP

IF: (c) If ((a) and (b) are both true

say "Low QRS voltage" LV. ATYP
"QRS deflection < 0.5/1.0 mV in limb/chest leads"

IF: R amp < S amp in leads I, II, & III

or S amp > 300 μV in I
and S amp > 400 μV in II
and S amp > 700 μV in III
and no R' is present in any of these leads
and S amp > 200 μV in leads I, II, & III
and age > 15

say "S1-S2-S3 pattern, consistent with pulmonary disease, RVH, or normal variant"
SSS. BO

PULMONARY DISEASE

Skip test if: QRS duration >= 120 ms

Criteria:

The test for pulmonary disease is based on counting how many of its typical characteristics are present. One point is awarded for each of:

(1) Right atrial enlargement
(2) QRS axis < -30
(3) QRS axis > 90
(4) QRS axis is indeterminate
(4) S1-S2-S3 pattern
(5) Low voltage in limb leads
(6) Low voltage in chest leads

Three points are awarded if:

QRS net amplitude is negative in lead V5 and the R (and R') amplitude in V6 < 500 μV.

IF: cumulative points > 3
say "Consistent with pulmonary disease"
PUL. ABN

Rationale:

There is room to doubt whether sufficient ECG criteria exist to diagnose pulmonary disease. However, if at least 4 (from a list of 8 distinct) features common to pulmonary disease are present, then the comment "consistent with" seems prudent.

RIGHT BUNDLE CONDUCTION

Criteria:

IF: (a) R amp > 100 μV and R dur > 20 ms and S is not present in V1 or V2

or

(b) R' amp > 100 μV and R' dur > 20 ms and S' is not present in V1 or V2

say "RSR (QR) in lead V1/V2 consisitent with right ventricular conduction delay" RSR. BO

IF: QRS duration > 90 ms
and S dur >= 40 ms in any 2 of leads I/aVL/V4/V5/V6
and either (a) or (b) is true

say "Incomplete right bundle branch block"
"90+ MS QRS duration, terminal R in lead V1/V2, 40+ MS S in lead I/AVL/V5/V6"
IRBBB. BO

IF: QRS duration >= 120 ms
and S dur >= 40 ms in any 2 of leads I/aVL/V4/V5/V6
and R dur < 100 ms in any 4 of leads I/AVL/V4/V5/V6
and QRS area > 0 in V1
and V1 does not terminate in S or S'

or

QRS duration > 105 ms
and S dur >= 60 ms in any 3 of leads I/aVL/V4/V5/V6
and R dur < 100 ms in any 4 of leads I/AVL/V4/V5/V6
and R or R' dur > 60 ms in V1
and QRS area > 0 in V1

say "Right bundle brance block" RBBB. ABN
"120+ MS QRS duration, upright V1, 40+ MS S in lead I/AVL/V5/V6"

and suppress Right Axis Deviation, Borderline

IF: Right bundle branch block is present
and R or R' amp > 1500 μV in V1
and QRS axis > 110

say "Right bundle branch block, plus possible RVH"
"RBBB, 1.5 mV R in V1, RAD" RBRVH. ABN

Rationale:

Right bundle branch conduction abnormalities exhibit anterior and rightward directed terminal forces. The rightward force should be noticeably prolonged. Thus, in addition to QRS conduction time criteria,

tests are included for a terminal positive wave in V1 and widened terminal positive wave in V1 and widened terminal S waves in at least 2 of the lateral leads.

Conventional criteria requires QRS widths in excess of 0.12 sec to read bundle branch block. However, very wide lateral S waves, a wide R in an upright V1, and a QRS duration > 105 ms will also be read as RBBB by most interpreters. This is the basis of the second portion of the complete RBBB test.

Specific criteria for RBBB + RVH are also included.

LEFT BUNDLE CONDUCTION

Criteria:

```
IF:     QRS duration > 105 ms
  and   QRS net amplitude < 0 in V1 & V2
  and   Q/S duration >= 80 ms in V1 & V2
  and   no Q is present in 2 of I/V5/V6
  and   R duration >= 60 ms in 2 of I/aVL/V5/V6

        say "Incomplete left bundle branch block"
                                                ILBBB.     ABN
            "105+ ms QRS duration, 80+ ms Q/S in lead V1/V2"
            "no Q and 60+ ms R in lead I/AVL/V5/V6"

        suppress Borderline Left Axis Deviation

IF:     QRS axis < -44
  and   R amp > Q amp in I & aVL
  and   a Q is present in I
  and   S or S' amp > R and R' amp in II

        say "Left anterior fascicular block"      LAFB.     ABN
            "QRS axis < -44, QR in I, RS in II"

  and   suppress Borderline and Abnormal Left Axis Deviation

IF:     S1-S2-S3 is not present
  and   Consistent with Pulmonary Disease has been ruled out.
  and   QRS axis >= 110
  and   R amp > Q amp in III & aVF
  and   a Q is present in III & aVF

        say "Left posterior fascicular block"     LPFB.     ABN
            "QRS axis > 109, inferior Q"

  and   suppress Borderline and Abnormal Right Axis Deviation

IF:     Incomplete Left Bundle Branch Block is present
  and   QRS area ratio  > 0.25 in I or V6
  and   R + R' duration >= 100 ms in 1 of I/aVL/V6
  and   QRS duration >= 160 ms

        or

             QRS duration >= 140 ms
             and the average R + R' duration > 83 ms in I/aVL/V6
        or
             QRS duration >= 120 ms
             and the average R + R' duration > 83 ms in I/aVL/V6
             and QRS area ratio > 0.4 in 2 of I/aVL/V6
```

```
say "Left bundle branch block"              LBBB.     ABN
    "120+ ms QRS duration, 80+ ms Q/S in lead V1/V2,
     85+ ms R in lead I/AVL/V5/V6"

suppress Borderline Left Axis Deviation
```

Rationale:

The meaining of ILBBB beyond describing an ECG pattern is unknown. For this reason the criteria for this statement are narrowly defined, and whenever a specific label such as left anterior fascicular block is available, the term ILBBB is suppressed.

The test for LBBB introduces a measurement called the "QRS area ratio", which is defined as the ratio of the QRS area (algebraic) to the area of a rectangle defined by QRS onset and offset and the peak positive amplitude. The area ratio is large whenever the QRS is upright and has a wide or notched R wave peak. The thresholds used in the above LBBB tests are empirically determined to correlate with typical LBBB patterns. The area ratio is used in lieu of R duration in order to better discriminate between true LBBB and a monophasic (upright) QRS with nonspecific terminal slurring of the R wave leading to increased QRS duration.

Strict criteria for fascicular blocks are used. This should be noted by readers who use simple axis deviation tests.

NONSPECIFIC CONDUCTION ABNORMALITY

Criteria:

IF: Right Bundle Branch Block
Incomplete Right Bundle Branch Block,
Left Bundle Branch Block,
Incomplete Left Bundle Branch Block,
Left anterior fasicular block,
Left posterior fasicular block,
RSR Pattern,
and QRS duration > 110 ms are not present.

say "Nonspecific intraventricular conduction delay"
"110+ ms QRS duration" IVCDF. BO

IF: Right Bundle Branch Block is not present
and Left Bundle Branch Block is not present
and QRS duration > 130 ms

say "Nonspecific intraventricular conduction block"
"130+ ms QRS duration" AVCB. ABN

and suppress Left anterior fascicular block, left posterior fascicular block and RSR in lead V1/V2 consistent with right ventricular conduction delay.

Rationale:

Intraventricular conduction delay is used to connote QRS widening which does not fit any previously defined pattern, and is not so great as to be considered block.

RIGHT VENTRICULAR HYPERTROPHY (RVH)

Skip test if: Right Bundle Branch Block is present
or Left Bundle Branch Block is present
or age < 16
or All of Q amp, S amp, or S' amp < 250 μV in I
or S amp > 1000 μV in V1
or QRS axis < 60
or QRS duration > 140 ms and net QRS amplitude < 0 in V1
or Q amp > S amp and R exists in I

Criteria:

The test for right ventricular hypertrophy is based on counting how many of (or in what degree) its common characteristics are present. One point is awarded for each of:

(1) R/R' amp > 500 μV in V1
(2) net QRS amp > 0 in μV in V1
(3) net QRS amp > 500 μV in V1
(4) net QRS amplitude < 0 and S amp > 500 μV in V5 or V6
(5) QRS axis >= 90
(6) QRS axis >= 100
(7) QRS axis >= 110
(8) Possible right atrial enlargement has been called.
(9) S1, S2, S3 is present
(10) age > 30
(11) if Indeterminate Axis is true, (in which case no points are given for QRS axis)

IF: cumulative points > 3

say "Possible right ventricular hypertophy"
RVH. ABN
"Some/all of: prominent R in V1, late transition RAD, RAE, S1-S2-S3"

suppress RAD.BO, RAD.ABN, LPFB.ABN, SSS.BO, RSR.BO, LVL.ATYP, LVV.ATYP, LV.ATYP, IVCD.BO

IF: cumulative points > 5

say "Right ventricular hypertrophy"
RVH. ABN
"Some/all of: prominent R in V1, late transition, RAD, RAE, S1-S2-S3"

IF: "Possible right ventricular hypertrophy" is called,
and STJ>STM>STE or one of (STM, STE, AND T) < -100 μV in V1, V2, and V3
and QRS duration < 120 ms

say "Right ventricular hypertrophy with repolarization abnormality" RVHR. ABN

"Some/all of: prominent R in V1, late transition, RAD, RAE, S1-S2-S3, right precordial ST depression"

Rationale:

STJ, STM, STE, and T, as used above refer to ST segment and T wave amplitudes at QRS offset, the midpoint of ST, the end of ST, and the peak of the T, respectively.

LEFT VENTRICULAR HYPERTROPHY (LVH)

Criteria:

Tests for LVH include various voltage criteria, QRS duration, repolarization abnormalities (strain), and left atrial enlargement (as a correlated factor). To arrive at composite voltage criteria, the common standard criteria are scored by degree of excess over the appropriate threshold. These thresholds depend on the age of the patient, as well as the lead or combination of leads.

Skip test if: "Left Bundle Branch Block" is present
or QRS duration > 140 ms and net QRS amplitude < 0 in V1.

Thresholds

Age/Measure	S(V1)	R(V5)	R(Max of V5 or V6) = S(V1)
<20	--	--	--
20-29	3.0 mV	3.0 mV	4.5 mV
30-39	2.4 mV	2.6 mV	4.0 mV
40 +	2.4 mV	2.6 mV	3.5 mV

A threshold of 1.1 mV for R(aVL) is used independent of age or sex.

Voltage criteria are scored as follows:

(1)	R/R'(aVL) > 1.1 mV	2 points + 1 point/0.1 mV excess
(2)	S/S'(V1) > threshold	2 points + 1 point/0.2 mV excess
(3)	R/R'(V5) > threshold	2 points + 1 point/0.2 mV excess
(4)	R/R'(V5/V6)+S/S'(V1) > threshold	2 points + 1 point/0.3 mV excess

The measure of QRS conduction time in the context of LVH is from QRS onset to the peak negative second derivative after the R peak in V5. Ordinarily, the latter point corresponds to the S nadir:

IF: cumulative points > 0: TEST 1
then LVH is possible

IF: cumulative points > 2: TEST 2
then moderate voltage criteria for LVH exists

IF: cumulative points > 4: TEST 3
then voltage criteria for LVH are present

IF: peak 2nd derivative - QRS onset > 68 ms in V5: TEST 4
then the conduction time threshold is met

IF: Atrial Fibrillation is not present: TEST 5
and (STE < STJ) and (STE < -50 μV) and (R amp > 1.1 mV) in at least one of I, aVL, V4, V5 and V6

or T(V1) > T(V6) + 200 μV

then LVH exists with repolarization abnormalities

```
IF:          the cumulative points are > 0:  TEST 1
        and  the conduction time threshold is exceeded:  TEST 4
        or   the criteria for possible LAE are met

        or   LVH with repolarization abnormalities exists

             then non-voltage criteria for LVH are present
             in addition, the statement IVCD, Borderline and
             ILBBB, Abnormal are suppressed

IF:          The cumulative points are > 0:  TEST 1
        and  no non-voltage criteria exist for LVH

             say "Minimal voltage criteria for LVH, may be nor-
                 mal variant"                    LVH.     BO

                 "Meets criteria in one of:  R(aVL), S(V1),
                 R(V5), R(V5/V6) +S(V1)"

IF:          the cumulative points are > 2:  TEST 2
        and  no non-voltage criteria exists for LVH

             say "Moderate voltage criteria for LVH, may be normal"
                                              LVH.     BO

                 "Meets criteria in one of:  R(aVL),S(V1),R(V5),
                 R(V5/V6)+S(V1)"

IF:          the cumulative points are > 4:  TEST 3
        and  no non-voltage criteria exists for LVH

             say "Voltage criteria for LVH"     LVHV.     ABN
                 "Meets criteria in one of:  R(aVL),S(V1),
                 R(V5),R(V5/V6)+S(V1)"

IF:          the non-voltage criteria are met
        and  repolarization abnormalities do not exist

             say "Possible left ventricular hypertrophy"
                                              LVHR.     ABN
                 "Voltage criteria plus LAE or QRS widening"

IF:          the non-voltage criteria are met
        and  repolarization abnormalities exists

             say "Left ventricular hypertrophy with repolariza-
                 tion abnormality"               LVHR.     ABN
                 "Voltage criteria plus ST/T abnormality"

IF:          the cumulative points are > 2:  TEST 2
        or   non-voltage criteria are present

             then a flag LVHF is set which is used in confunc-
             tion with other criteria
```

Rationale:

ECG criteria for LVH are, to be brief, imperfect. The sensitivities of various favorite voltage criteria are no better than 30-40%. Specificities greater than 90% may initially seem sufficient, but application to a general population would evidently generate more false than true positives. The philosophy in the above criteria has been to combine several voltage criteria in order to increase the net sensitivity. In order to minimize the impact of an unavoidable decrease of specificity, records minimally exceeding only one criterion and exhibit no non-voltage criteria are identified as possible normal variants. In all cases, records meeting only voltage criteria are identified as such.

Non-voltage tests for LVH include the presence of left atrial enlargement, QRS widening, and repolarization changes. Whenever any of these are present in combination with at least one voltage criterion, a stronger statement is made. A new measure of QRS widening is used in place of intrinsicoid deflection time and/or the total QRS width. Instead, an attempt is made to measure the duration of leftward forces in lead V5. The motivation is to be more sensitive than intrinsicoid timing, while avoiding spurious increases in total QRS duration.

Repolarization changes, for the purpose of identifying non-voltage LVH criteria, include depressed, downsloping ST segments in any of the lateral leads, or a T amplitude in V1 greater than that in V6.

MYOCARDIAL INFARCTION DISCUSSION

Computer criteria for infarction depart from standard textbook criteria in greater degree than most electrocardiographers would probably expect. The reason is that conventionally accepted criteria describe stereotypical infarction. When these criteria are applied, they have a high specificity, but a very low sensitivity. For example, a recent review of inferior infarct criteria reported a sensitivity of only 4% using New York Heart Association criteria. In order to achieve more useful results, computer programs must incorporate some of the same unpublished "gestalt" used by experienced ECG interpreters.

Conventional criteria focus on Q wave duration as the primary test for the presence of infarction, and the computer tests below naturally retain this focus. The single most important additional criterion, oddly enough seldom mentioned in reviews in infarction criteria, is a test for repolarization abnormalities characteristic of acute or recent infarction. For example, elevated ST segments and negative T waves are strong indicators of infarction in presence of otherwise non-diagnostic Q waves. Taking into account these repolarization abnormalities greatly increases both sensitivity and specificity for new or recent infarcts. For old infarcts, the problem is more complex. But gains can be made by considering Q and R wave amplitudes, and QRS duration. These factors are quantitatively added below by converting to "Q duration equivalents". Thus for every 30 μV of Q amplitude, 1 ms is added to the actual Q duration to obtain an "equivalent" duration. Likewise, for each 120 μV of R amplitude, 1 ms is subtracted, and for every 4 ms of QRS duration beyond 100 ms, 1 ms is added (up to a maximum correction of 5 ms), or subtracted for durations less than 100 ms. This last factor attempts to exploit the frequent increase in QRS duration concomittant with infarction, whether due to LVH, peri-infarction block, or whatever. To further reduce the impact of a wide, but very small Qs, the equivalent duration is reduced by 1 ms for every 12 μV that the Q amplitude is short of 100 μV.

Age and sex affect the "a priori" probability of infarction. These factors are also incorporated by modifying the equivalent Q duration. For males, 1 ms is subtracted from the equivalent Q for every 2 years uder the age of 40, up to a maximum correction of 10 ms. Likewise, for females, 1 ms is subtracted for every 2 years under 50, again up to a maximum of 10 ms.

It should be noted that the above adjustments to the equivalent Q duration are not very large, and so they should not be expected to cause unreasonable departures from conventional interpretation. Mostly, they can be expected to affect the certainty attached to a given interpretation.

With some exception, infarct diagnostic statements are given qualifiers intended to reflect the certainty of the particular interpretation. These qualifiers are:

Cannot rule out...	Typical	equivalent	Q	duration	30-24 ms
Possible ...	"	"	"	"	35-39 ms
(Unqualified)...	"	"	"	"	40+ ms

The presence of repolarization abnormalities characteristic of the infarct can cause the qualifier to be omitted (i.e., upgrade to strongest statement).

ANTERIOR MYOCARDIAL INFARCTION (AMI)

Define: Alternate T amp =:
(1) if T' is not present, T - larger of STE of Tend
(2) if T' is present, lesser of T & T' - larger of STE or Tend

Skip test if: "Left bundle branch block" is present
or QRS duration > 140 ms and net QRS amplitude < 0 in V1

Criteria:

IF: STM and STE amp > 200 μV in V3 and V4
and Alternate T amp >= 0 in V3 and V4
and T is not upward inflected in V3 and V4
then the conditions for a new AMI are present.

IF: STM and STE amp > 50 μV in V3 or V4
and Alternate T amp < 0 in V3 or V4
then the conditions for a recent AMI are present.

IF: the criteria for a new or recent AMI are not met
and STM amp < 30 μV in V3 and V4
and Alternate T amp >= 0 in V3 and V4
then the conditions for an old AMI are present.

IF: the criteria for a new, recent or old AMI are not met
then the age description is, "age undetermined"

IF: Equivalent Q dur >= 30 ms in V2 or V4
then Test 1 for AMI is positive.

IF: Equivalent Q dur >= 30 ms in V3 or V5
then Test 2 for AMI is positive.

IF: Equivalent Q dur >= 30 ms in V3
and
Test 1 for AMI is positive
or
Equivalent Q dur >= 30 ms in V4
and
Test 2 for AMI is positive
or
R amp < 200 μV in V4

then the statement "cannot rule out AMI" is used when appropriate.

IF: Equivalent Q dur >= 35 ms in V3
and
the equivalent Q dur > 30 ms in V2 or V4: (TEST 1)
and
LVH is not present

or

Equivalent Q dur >= 35 ms in V4

and

the equivalent Q dur > 30 ms in V3 or V5: (TEST 2)

then the test for an AMI is positive

IF: Equivalent Q dur >= 40 ms in V3

and

Test 1 for AMI is positive

and

LVH is not present

and

low voltage in the chest leads is not present

and

non-specific intraventricular conduction block is not present

or

Equivalent Q dur >= 40 ms in V4

and

Test 2 for AMI is positive

or

cannot rule out AMI is true

and

either Recent or New criteria have been met
then an AMI exists and it will be classified as unqualified

IF: the measurements suggest that an AMI may exist

say "Cannot rule out anterior myocardial infarction"
CROAMI. ABN

"30 mS Q wave in lead V3/V4 or R < 0.2 mV in V4"

IF: positive criteria for an AMI exist

say "Possible anterior myocardial infarction"
POSAMI. ABN

"35 mS Q wave in lead V3/V4"

IF: an "unqualified" AMI exists

say "Anterior myocardial infarction" AMI. ABN
"40+ mS Q wave and/or ST/T abnormality in lead V3/V4"

IF: any AMI criteria are met, append one of the following qualifiers

if the AMI is new
append ", POSSIBLY acute NEW

```
if the AMI is new
append ", PROBABLY recent"                    REC

if the age of the AMI is undetermined
append ", AGE undetermined"                   AU

if the AMI is old
append ", PROBABLY old"                       OLD
```

SEPTAL MYOCARDIAL INFARCTION (SMI)

Skip test if: Left Bundle Branch Block is present
or
if AMI cannot be ruled out
and
Q amp = 0 in V1
or
QRS duration > 140 ms and net QRS amplitude ≤ 0 in V1

Criteria:

IF: STM and STE amp > 200 μV in V2
and Alternate T amp >= 0 in V2
and T is not upward inflected in V2
then a "new" septal infarct is present

IF: STM and STE amp > 50 μV in V2
and Alternate T amp < 0 in V2
then a "recent septal infarct is present

IF: the septal infarct is not new or recent
and STM amp ≤ 50 μV in V2
and Alternate T amp >= 0 in V2
then the septal infarct is "old"

IF: the criteria for a septal infarct have been met and it is neither new, recent, or old, the qualifier "age undetermined" will be used

IF: Equivalent Q dur >= 30 ms in V2
or
Right Bundle Branch Block is present
and
Equivalent Q dur > 20 ms in V2

then a septal infarct, "cannot be ruled out"

IF: Equivalent Q dur >= 35 ms in V2
and
LVH is not present

then positive criteria for a septal infarct exist

IF: Equivalent Q dur >= 40 ms in V2
and
LVH is not present

then a septal infarct is present

IF: a septal infarct cannot be ruled out

say "Cannot rule out septal myocardial infarction"
CROSMI. ABN

"30 mS Q wave in lead V1/V2"

IF: positive criteria for a septal infarct exist

say "Possible septal myocardial infarction" POSSMI. ABN

"35 ms Q wave in lead V1/V2"

IF: a septal infarct is present

say "Septal myocardial infarction" SMI. ABN
"40+ ms Q wave in lead V1/V2"

IF: any SMI criteria are met, append one of the following qualifiers.

if the SMI is new"
append ", POSSIBLY acute" NEW

if the SMI is "recent"
append ", PROBABLY recent" REC

if the age of the SMI is undetermined
append ", AGE undetermined" AU

if the SMI is "old"
append ", PROBABLY old" OLD

ANTEROSEPTAL MYOCARDIAL INFARCTION (ASI)

Skip test if: positive criteria for a Lateral Infarct exists

Criteria:

IF: both an AMI and a SMI cannot be ruled out

say "Cannot rule out anteroseptal myocardial infarction" ASCRO. ABN
"30 ms Q wave in lead V1-V4"

IF: an anteroseptal infarct cannot be ruled
and either positive AMI or SMI is called

say "Possible anteroseptal myocardial infarction" ASPOS. ABN
"35 ms Q wave in lead V1-V4"

IF: an anteroseptal infarct cannot be ruled out
and either an unqualified anterior or septal infarct exists

say "Anteroseptal myocardial infarction" ASUNQ. ABN

"40+ ms Q wave in lead V1-V4"

IF: either a recent SI or AI has been called
then "probably recent" will be appended
to the ASI call. REC

IF: the ASI is not recent
and either a new SI or AI exists then
"possibly acute" is appended to the ASI call NEW

IF: the ASII is not new
and calls of SI age undetermined and/or AI age undetermined are present

then "age undetermined" is appended to the ASI call AU

IF: both SI old and AI old are called
then "probably old" is appended to the ASI call OLD

LATERAL MYOCARDIAL INFARCTION (LMI)

Criteria:

IF: STM and STE amp > 200 μV in V5 & V6
and STM and STE amp > 100 μV in I & AVL
and Alternate T amp >= 0 in I, AVL, V5 & V6
and T is not upward inflected in I, AVL, V5 & V6
then a new lateral infarct is present

IF: STM and STE amp > 50 μV in I, AVL, V5 or V6
and Alternate T amp < 0 in I, AVL, V5 or V6
then a recent lateral infarct is called.

IF: the criteria for new or recent LMI are not met
and STM < 30 μV in I, AVL, V5 and V6
and Alternate T amp >= 0 in I, AVL, V5 and V6
then an old LMI is present

IF: a new, recent or old LIM are not called
then an unqualified LMI is present

IF: Equivalent Q dur >= 30 ms in 2 of I/V5/V6
and a LMI cannot be ruled out

then a LMI is present

IF: Equivalent Q dur >= 40 ms in 1 of I/V5/V6
and a LMI is present
or
a LMI "cannot be ruled out"
and either a new or recent LMI is called

. then an unqualified LMI is defined

IF: a LMI cannot be ruled out

say "Cannot rule out lateral myocardial infarction"
CROLMI. ABN

"30 ms Q wave in lead I/AVL/V5/V6"

IF: a LMI is present

say "Possible lateral myocardial infarction"
POSLMI. ABN

"35 ms Q wave in lead I/AVL/V5/V6"

IF: the LMI is unqualified

say "Lateral myocardial infarction" LMI. ABN
"40+ ms Q wave in lead I/AVL/V5/V6 and/or
ST/T abnormality in lead I/AVL/V5/V6"

IF: a LMI exists one of the following will be appended to the LMI statement.

if a "new" LMI is present append ", possibly acute"	NEW
if a "recent" LMI is present append ", probably recent"	REC
if an "age undetermined" is qualified append ", age undetermined"	AU
if the LMI is "old" append ", probably old"	OLD
if Q(I) amp > S(I) amp euppress RAD.BO, RAD.ABN	

ANTEROLATERAL MYOCARDIAL INFARCTION (ALMI)

Criteria:

IF: both an AMI and a LMI "cannot be ruled out"

say "Cannot rule out anterolateral myocardial infarction" ALCRO. ABN

"30 ms Q wave in lead I/AVL/V3-V6"

IF: either an AMI or a LMI are called

say "Possible anterolateral myocardial infarction" ALPOS. ABN

"35 ms Q wave in lead I/AVL/V3-V6"

IF: either an unqualified AMI or LMI is present

say "Anterolateral myocardial infarction" ALUNQ. ABN

"40+ ms Q wave in lead I/AVL/V3-V6"

IF: either a recent LMI or AMI is present
then "probably recent" is appended
to the ALMI statement REC

IF: the infarct is not a recent ALMI
and a new LMI or AMI is present
then a "new" ALMI is present and "probably acute"
is appended to the statement. NEW

IF: the infarct is not a new ALMI
and an age undetermined LMI and/or an age undetermined AMI is present
then an "age undetermined" ALMI is present and
"age undetermined" is appended to the record AU

IF: both the LMI and AMI are qualified as "old"
the ALMI call will be qualified as "probably old"
OLD

INFERIOR MYOCARDIAL INFARCTION (IMI)

Criteria:

IF: STM and STE amp > 100 μV in II and aVF
and Alternate T amp >= 0 in II & aVF
and T is not upward inflected in II & aVF
then a "new" IMI is present

IF: STM and STE amp > 50 μV in II or aVF
and Alternate T amp < 0 in II or aVF
then a "recent" IMI is present

IF: the IMI is not new or recent
and STM amp < 30 μV in II and aVF
and Alternate T amp >= 0 in II and aVF
then the IMI is "old"

IF: the IMI is not new, recent or old
then the qualifier "age undetermined" will be used

IF: Equivalent Q dur >= 30 ms in II or aVF
and
Q(I) amp < Q(II) amp
or
Q(I) amp < Q(aVF) amp

then an IMI "cannot be ruled out"

IF: Equivalent Q dur >= 35 ms in II or aVF
and an IMI cannot be ruled out

then an IMI is probably present

IF: an IMI cannot be ruled out
and
Equivalent Q dur >= 40 ms in II or aVF
or
the IMI is new or recent

then the IMI is "unqualified"

IF: an IMI cannot be ruled out

say "Cannot rule out inferior myocardial infarction"
CROIMI. ABN

"30 ms Q wave in lead II/aVF"

IF: an IMI is probably present

say "Possible inferior myocardial infarction
POSIMI. ABN

"35 ms Q wave in lead II/aVF"

IF: the IMI is unqualified

say "Inferior myocardial infarction" IMI. ABN
"40+ mS Q wave and/or ST/T abnormality in lead II/aVF"

if QA > SA in 1 of II/aVF
suppress Abnormal left Axis Deviation

IF: the IMI is "new"
append ", possibly acute" NEW

if the IMI is "recent"
append ", probably recent" REC

if the age of the IMI is undetermined
append ", age undetermined" AU

if the IMI is "old"
append ", probably old" OLD

INFERIOR MYOCARDIAL INFARCTION WITH POSTERIOR EXTENSION (PMI)

Skip test if: an IMI is not present
or Right Bundle Branch Block is present

Criteria:

IF: Q amp = 0 in V1 & V2
and
R dur >= 40 ms in V1 & V2
or
R dur >= 35 ms and QRS net amplitude > 0 in V1 or V2
or
R dur >= 30 ms and QRS net amplitude > 0 in V1 and V2

append "with posterior extension" to the IMI statement PMI. ABN

and suppress RVH.ABN, RVHR.ABN, IRBBB.BO

MYOCARDIAL INFARCTION SUPRESSIONS

IF: an IMI, LMI, AMI or SMI is present then

suppress LAD.BO, ILBBB.ABN, AVCD.BO

IF: an AMI or a LMI is present

suppress PUL.ABN

ST SEGMENT ELEVATION

Skip test if: one of the following is present, RBBB, LBBB, IVCB., MI or LVHR.

Criteria:

IF: STJ/STM/STE all μ= 50 μV and T is not upward inflected in 2 of I,II,III,aVF,V3-V6

say "Nonspecific ST elevation" NSTE. BO "0.05+ mV ST elevation"

EARLY REPOLARIZATION

Skip test if: Corrected QT interval > 450 ms or any of the following are present: MI, LVH, RBBB, LBBB, IVCB

Criteria:

IF: count of leads V1-V6 for which STJ and STM amp > 75 μV plus count of leads I,II,III,aVL,aVF for which STJ & STM > 50 μV exceeds 2

and sum of STJ amplitudes > 450 μV for leads passing above test

say "ST elevation, consistent with epicardial injury, pericarditis, or early repolarization" STE1. ABN

"ST elevation w/o normally inflected T wave"

IF: ST elevation is present, per the above conditions

and more than 1/2 of the leads passing ST elevation test above also have well-inflected T waves

say "ST elevation, probably early repolarization" "ST elevation with normally inflected T wave" STE2. BO

IF: above count > 5 and sum > 450 μV

say "Early repolarization" EREP. NML "ST elevation with normally inflected T wave'

PERICARDITIS

Skip test if: any of the following are present:
MI, RBBB, LBBB, IVCB, LVH

Criteria:

IF: 4 times STJ amp > T amp > 0 in at least 4 of I, II, V4-V6

and STJ and STM amp > -100 μV in all leads except aVR

and count of leads I, II, aVF with STJ and STM amp > 75 μV plus count of leads V2-V6 with STJ and STM amp > 90 μV is greater than or equal to 5.

say "Possible acute pericarditis" PCRD1. ABN

"Marked ST elevation without normally inflected T wave"

IF: Possible acute pericarditis is present

and count of leads I, II, aVF with STJ and STM amp > 90 μV plus count of leads V2-V6 with STJ and STM amp > 110 μV is greater than or equal to 5.

say "Acute pericarditis" PCRD2. ABN
"Marked ST elevation without normally inflected T wave"

suppress NSTE.BO,STE1.ABN,STE2.BA,EREP.NML

ANTERIOR AND SEPTAL SUBEPICARDIAL INJURY

Skip test if: any of the following are present:
PCRD, LBBB, RBBB, IVCB

Define: ST LIMIT = 300 μV
(add 100 μV for any precordial lead with net QRS amp < 0)

Criteria:

IF: STJ amp > ST LIMIT/2
and T is not upward inflected in V1 and V2
and Alternate T amp >= 0 in V1 and V2
and a septal infarct is not present
and LVH is not present

say "Possible septal subepicardial injury" SINJ. ABN

"Marked ST elevation without normally inflected T wave in lead V1/V2"

IF: STJ amp > ST LIMIT
and T is not upward inflected in V1 and V2
and Alternate T amp >= 0 in V1 and V2
and a septal infarct is not present
and LVH is not present

say "Septal subepicardial injury" SINJ. ABN
"Marked ST elevation without normally inflected T wave in lead V1/V2"

IF: STJ amp > ST LIMIT/2
and T is not upward inflected in 2 of V2-V5
and Alternate T amp >= 0 in V2-V5
and an anterior infarct is not present
and LVH is not present

say "Possible anterior subepicardial injury" AINJ. ABN

"Marked ST elevation without normally inflected T wave in lead V2-V5"

IF: STJ amp > ST LIMIT
and T is not upward inflected in 2 of V2-V5
and Alternate T amp >= 0 in V2-V5
and an anterior infarct is not present
and LVH is not present

say "Anterior subepicardial injury" AINJ. ABN

"Marked ST elevation without normally inflected T wave in lead V2-V5"

IF: there is a possible anterolateral subepicardial injury
and both possible anterior and possible septal subepicardial injury exist

say "Possible anteroseptal subepicardial injury"
ASINJ. ABN

"Marked ST elevation without normally inflected T wave in lead V1-V4"

IF: there is a possibility of anteroseptal subepicardial injury
and additional criteria substantiates an Anterior Injury or Septal Injury

say "Anteroseptal myocardial infarction"
ASINJ. ABN

"40+ mS Q wave in lead V1-V4"

LATERAL AND INFERIOR SUBEPICARDIAL INJURY

Skip test if: any of the following are present:
PCRD, LBBB, RBBB, IVCB

Criteria:

IF: STJ amp > ST LIMIT/2
and T is not upward inflected in 2 of I,AVL,V5 and V6
and Alternate T amp >= 0 in I,AVL,V5 and V6
and a LMI cannot be ruled out

say "Possible lateral subepicardial injury"
LINJ. ABN

"ST elevation without normally inflected T wave in lead I/AVL/V5/V6"

IF: STJ amp > ST LIMIT
and T is not upward inflected in 2 of I,AVL,V5 and V6
and Alternate T amp >= 0 in I,AVL,V5 and V6
and a LMI cannot be ruled out

say "Lateral subepicardial injury" LINJ. ABN
"Marked ST elevation without normally inflected T wave in lead I/AVL/V5/V6"

IF: both the possibility of anterior and lateral injury exist

say "Possible anterolateral subepicardial injury"
ALINJ. ABN

"Marked ST elevation without normally inflected T wave in lead V3-V6"

IF: an anterlateral subepicardial injury possibly exists
and an anterior and/or lateral injury exists

say "Anterior subepicardial injury"
"Marked ST elevation without normally inflected T wave in lead V3-V6" ALINJ. ABN

IF: STJ amp > ST LIMIT/2
and T is not upward inflected in II and aVF
and Alternate T amp >= 0 in II and AVF
and an IMI is not present

say "Possible inferior subepicardial injury"
IINJ. ABN

"ST elevation without normally inflected T wave in lead II/aVF"

```
IF:         STJ amp > ST LIMIT
      and   T is not upward inflected in II and aVF
      and   Alternate T amp >= 0 in II and AVF
      and   an IMI is not present

            say "Inferior subepicardial injury"   IINJ.     ABN

                "Marked ST elevation without normally inflected
                T wave in lead II/aVF"
```

ST DEPRESSION

Skip tests if: LBBB, IVCB, LVHR, or PCRD is present

IF: RVHR, STEL, and RBBB are not present
and STJ amp < -100 μV and STE amp >= 0 in 2 leads (except aVR and III)

say "Junctional ST depression, probably normal" NJDEP. BO

"0.1+ mV Junctional ST depression"

IF: RVHR, STEL and RBBB are not present
and STJ < -100 μV and STE < 0 and STE >= STJ/2 in 2 leads (except aVR and III)

say "Abnormal Junctional ST depression" AJDEP. ABN

"Junctional ST depression iwth weak upslope"

IF: RVHR, STEL, and RBBB are not present
and STM or STE < both STJ and -50 μV in 2 leads (except aVR and III)

say "ST depression, possible digitalis effect" STDIG. ABn

"Downsloping or coved ST depression"

IF: RVHR, STEL, and RBBB are not present
and STJ/STM/STE all < -25 μV in 2 leads (except aVR and III)

say "Minimal ST depression" NST1. BO
"0.025+ mV ST depression"

IF: RVHR, STEL and RBBB are not present
and (STM < -50 μV and STE < 0) or STE < all of STJ/STM/-50 μV in 2 leads (except aVR and III)

say "Moderate ST depression" NST2. ABN
"0.05+ mV ST depression"

IF: STJ/STM/STE all < -100 μV in 2 leads (except aVR and III and except V1/V2 if RBBB is present or RVHR is present)

say "Marked ST depression, possible subendocardial injury" NST3. ABN

"0.1+ mV ST depression"

IF: STJ/STM/STE all < -200 μV in 2 leads (except aVR and III and except V1/V2 if RBBB is present or RVHR is present

say "Marked ST depression, consistent with subendocardial injury" NST3. ABN "0.2+ mV ST depression"

IF: atrial fibrillation is present and either minimal or moderate ST depression is present

append ", probably digitalis effect" PDIG.

IF: atrial fibrillation is present and there is "marked" ST depression

append ", or digitalis effect" ODIG.

T WAVE ABNORMALITY, ISCHEMIA

Skip test if: any of the following are true:
LBBB, IVCB, LVHR, RVHR, SBIN, STEL, PCRD

IF: an AMI is not present
and RVHR is not present
and Alternate T amp ≤ -100 μV in 2 of V2/V3/V4 (excluding V2 if RBBB is present"

say "T wave abnormality, possible anterior ischemia"
"-0.1+ mV T wave in lead V3/V4"
POSAI. ABN

IF: an AMI is probably present
and Alternate T amp ≤ -500 μV in 1 of V2/V3/V4 (excluding V2 if RBBB is present)

say "T wave abnormality, consistent with anterior ischemia"
"-0.5+ mV T wave in lead V3/V4"
AI. ABN

IF: a LMI is not present
and Alternate T amp ≤ -100 μV in 2 of I/aVL/V4/V5/V6 (excluding aVL if R(aVL) ≤ 500 μV)

say "T wave abnormality, possible lateral ischemia"
"-0.1+ mV T wave in lead I/aVL/V5/V6"
POSLI. ABN

IF: a T wave abnormality is present and lateral ischemia is possible,
and Alternate T amp ≤ -500 μV in 1 of I/aVL/V5/V6 (excluding aVL if R(aVL) ≤ 500 μV)

say "T wave abnormality, consistent with lateral ischemia"
"-0.5+ mV T wave in lead I/aVL/V5/V6"
LI. ABN

IF: both AMI and LMI are probably present

say "T wave abnormality, possible anterolateral ischemia"
"-0.1+ mV T wave in lead V3-V6"
POSALI. ABN

IF: a T wave abnormality is present with possible anterolateral ischemia,
and an AMI and a LMI exist

say "T wave abnormality,, consistent with anterolateral ischemia"
"-0.1+ mV T wave in lead V3-V6"
ALI. ABN

IF: nonspecific ST abnormalities exist
and if an AMI and/or a LMI exist

prefix "ST & " to the T wave abnormality statement STP.

IF: atrial fibrillation is present
and if an AMI and/or a LMI exists

append "or digitalis effect" PDGAL.

IF: an IMI is not present
and Alternate T amp ≤ -100 μV in II or aVF (excluding aVF if net QRS amplitude ≤ 0)
and Alternate T amp ≤ 0 in II and AVF

say "T wave abnormality, possible inferior ischemia" POSII. ABN

"-0.1+ mV T wave in II/aVF"

IF: an IMI is probably present
and non-specific ST abnormalities exist

prefix "ST & " on the previous statement STP2.

IF: an IMI is probably present
and atrial fibrillation is present

append "or digitalis effect" to the T wave abnormality statement. PDGI.

IF: an IMI is present
and Alternate T amp ≤ -500 μV in II or aVF (excluding aVF if net QRS amplitude ≤ 0)

say "T wave abnormality, consistent with inferior ischemia" II. ABN

"-0.5 mV T wave in lead II/aVF"

T WAVE ABNORMALITY, NONSPECIFIC

Skip test (except test Short QT) if:
any of the following exist: LBBB, IVCB, LVHR, RVHR, SBIN, STEL, PCRD, MI, RBBB, AMI, LMI or IMI.

Define: TMIN = "
(1) 25 μV + net QRS amplitude/20 if net amplitude ≥ 0
(2) 25 μV if net amplitude < 0

IF: QRS axis - T axis ≥ 60
and
T axis < 0
or
QRS axis - T axis ≤ -60
and
T axis ≥ 90

say "Abnormal QRS-T angle" QRST. BO
"QRS-T axis difference ≥ 60"

IF: count of I/II/aVL/V3-V6 with alternate T amp < TMIN and R amp ≥ 500 μV is greater than 1

say "Nonspecific T wave abnormality" NT. ABN

IF: nonspecific ST abnormalities and nonspecific T-wave abnormalities exist
and
Tall T waves are not present

say "Nonspecific ST & T wave abnormality"
NSTT. ABN

IF: atrial fibriallation is present
and either nonspecific T wave or ST abnormalities exist

append ", probably digitalis effect" PDIG.

IF: T amp ≥ 1000 μV and T amp ≥ 1/2 R amp in 3 of I/II/V1-V6
or T amp ≥ 1500 μV in 1 of I/II/V1-V6

say "Tall T waves, possible hyperkalemia"
TALLT. ABN
"T ≥ both 1/2 R and 1mV in 3 leads"

IF: QTc < 360 ms
and Heart Rate ≤ 140
say "Short QT interval" SQT. ABN

IF: QTc ≥ 450 ms

say "Long QT interval" LQT. ABN

VIII: Rhythm Statements

The following rhythm statements are used to describe the predominant rhythm in the 10 seconds of analyzed data. In addition to the main rhythm statement, a modifier, listed after the rhythm statements, may also be added.

Sinus Tachycardia
Sinus Rhythm
Sinus Bradycardia

Atrial Tachycardia (abnormal P axis)
Atrial Rhythm
Atrial Bradycardia

Junctional Tachycardia (superior P axis and Short PR)
Junctional Rhythm
Junctional Bradycardia

Supraventricular Tachycardia (narrow QRS, regular RR, no P)
Supraventricular Rhythm
Supraventricular Bradycardia

Undetermined [regular] rhythm

Atrial fibrillation

a. Rhythm Statement - Modifiers

The following modifiers will be used in conjunction with the above rhythm statements in order to more accurately describe the type of rhythm.

..... with [marked] sinus arrhythmia 20/40% RR variation

..... with 1° AV block

..... with short PR interval

..... with 2° AV block, Mobitz Type [I, II]

..... with [occasional/frequent] ventricular premature complexes

..... with [occasional/frequent] ectopic premature complexes

..... with [occasional/frequent] atrial premature complexes

..... with [occasional/frequent] supraventricular complexes

..... in a pattern of bigemiry

..... with marked rhythm irregularity, possible non-conducted PAC, SA block, AV block, or sinus pause.

The following two statements are used with atrial fibrillation

..... with [rapid/slow] ventricular response

..... with AV block

The following statement is used with atrial flutter

..... with aberrant conduction or ventricular premature complexes

..... cannot rule out atrial flutter (Regular rate near 150)

..... electronic [atrial/ventricular] pacemaker

..... contour analysis based on intrinsic rhythm

..... intermittent WPW pattern